

# BLUE RIVER GAME FISH POPULATION ESTIMATES

Crawford, Harrison, and Washington Counties

2004 Completion Fish Management Report

Daniel P. Carnahan  
Fisheries Biologist



Fisheries Section  
Indiana Department of Natural Resources  
Division of Fish and Wildlife  
I.G.C. South, W-273  
402 W. Washington Street  
Indianapolis, Indiana 46204

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## EXECUTIVE SUMMARY

- The Blue River watershed is located in southcentral Indiana and comprises 125,000 acres in Clark, Crawford, Floyd, Harrison, and Washington Counties. The Blue River is a tributary of the Ohio River and intersects it approximately three miles east of the town of Leavenworth. The river is best described as a high quality, high gradient stream which receives a substantial portion of its discharge from subterranean sources. The lower five miles of river are more indicative of a southwest Indiana lowland river.
- Sampling was conducted from September 27 to 29, 2004 at the same five stations used in previous game fish population estimates. A pulsed D.C. tote barge electrofisher was used at four of the stations and pulsed D.C. electrofishing boat was used at one station. Smallmouth bass, spotted bass, rock bass, and largemouth bass were the target species.
- A total of 252 rock bass was sampled that ranged in length from 1.4 to 9.3 inches. Rock bass growth was comparable to the Interior Plateau Ecoregion average. The rock bass population estimates ranged from 253 to 1,140 per mile and averaged 698 per mile. The rock bass population has increased by 58% since 1998.
- A total of 162 smallmouth bass was sampled that ranged in length from 1.8 to 13.2 inches. Smallmouth growth decreased since 2002 for all ages and is at historic lows for the river. Smallmouth bass population estimates (excluding young-of-the-year) ranged from 54 to 493 per mile and averaged 248 per mile. The 2002 and 2004 population estimates increased by 211% and 158% from 1998 levels.
- The quality of the smallmouth bass population has deteriorated since the 12-inch minimum length limit was imposed in 1998. Smallmouth growth is poor and it appears that smallmouth bass harvest and/or natural mortality is impacting the number of older bass in the population because very few older bass (ages 5, 6, and 7) have been sampled over the last three population estimates. It is recommended that the current length limit be changed to a black bass 12 to 15-inch protective slot size limit. Also, the black bass bag limit should be changed to five bass of which no more than two can be 15 inches or larger. Population estimates should continue in the future to monitor the fishery under the new regulations.

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## INTRODUCTION

The Blue River watershed is located in southcentral Indiana and comprises 125,000 acres in Clark, Crawford, Floyd, Harrison, and Washington Counties. The Blue River is a tributary of the Ohio River and intersects it approximately three miles east of the town of Leavenworth. Most of the watershed in Washington, Floyd, and Clark Counties is agricultural while Harrison and Crawford Counties are heavily forested. The river is best described as a high quality, high gradient stream which receives a substantial portion of its discharge from subterranean sources. The lower five miles of river are more indicative of a southwest Indiana lowland river. A black bass (smallmouth, spotted, largemouth) 12-in minimum size limit was enacted in the summer of 1998 in all streams and rivers. There was no previous length limit on black bass in the Blue River.

Harrison-Crawford State Forest, Wyandotte Caves, and Wyandotte Woods are located on the lower twenty miles of the Blue River. Forty-five miles of Blue River in Washington, Harrison, and Crawford Counties were designated as a “State Scenic River” in 1975 to help prevent public and private projects which would destroy the river’s natural features.

Previous Blue River fisheries surveys were conducted in 1972, 1993, and 2000 (Janisch 1972, Stefanavage 1995, and Carnahan 2001). Game fish population estimates have been conducted in 1998, 1999, 2000, and 2002, and a recreational use survey was conducted in 1999 (Carnahan 1999, 2000, 2001, and 2002).

The game fish population estimates were conducted under work plan 98759 entitled, “Evaluation of Game Fish Populations and Recreational Uses on Indiana Streams.” Work plan objectives are to provide 29,000 angler days with a satisfaction of at least 31% and to maintain the presence of native stream fishes. Much of the work outlined in the work plan was directed at gathering enough data to determine the effectiveness of the new black bass size limit. This work plan’s ending date is June 30, 2006.

## METHODS

Sampling was conducted from September 27 to 29, 2004 at the same five stations used in previous game fish population estimates. Sampling reach lengths were determined from a hand held global positioning system unit. A pulsed D.C. tote barge electrofisher was used to sample fish at four of the stations (river miles (RM) 9.0, 14.7, 54.5, and 62.4). A pulsed D.C.

electrofishing boat was used at RM 34.6. River mile designations were labeled according to Hogatt (1975). All electrofishing was conducted during the day and two dippers collected stunned fish at all stations. Both ends of each sampling station were blocked off with a block net unless a shallow riffle was available to prevent game fish passage. Smallmouth bass, spotted bass, rock bass, and largemouth bass were the target species.

All fish collected were measured to the nearest 0.1 in and weighed to the nearest 0.01 lb. Scale samples were collected for age and growth analysis. Population estimates were obtained by using the depletion method and expanded with the Microfish 3.0 computer program (Van Deventer and Platts, 1986). Proportional stock density (PSD) and relative stock density (RSD) were calculated for rock bass and smallmouth bass (Anderson & Neumann 1996). The smallmouth bass population was modeled using the Fishery Analyses Simulation Tools (FAST) (Slipke and Maceina 2001).

## RESULTS

### Rock bass

A total of 252 rock bass was sampled that weighed 31.65 lbs (Appendix 1). They ranged in length from 1.4 to 9.3 in. The rock bass PSD was a record low (18) and the relative stock density for rock bass at least 8 in long (RSD8) was 9 which was near the record low of 8 (Figure 1). Previous PSD's have ranged from 29 (2000) to 39 (2002), while RSD8 values have ranged from 8 (1993) to 16 (2000). Rock bass growth decreased for ages 1 through 4 and remained the same for ages 5 and 6 compared to 2002 results. Growth was comparable to the Interior Plateau Ecoregion average and is still above previous survey results (Table 1).

Rock bass population estimates ranged from 253/mi (RM 9.0) to 1,140/mi (RM 14.7) and averaged 698/mi. Previous average population estimates ranged from 113/mi (2000) to 589/mi (2002) (Figure 2). The rock bass population has increased by 58% since 1998. Population estimates by river mile by year are listed in Appendix 2.

### Smallmouth bass

A total of 162 smallmouth bass was sampled that weighed 29.25 lbs (Appendix 1). They ranged in length from 1.8 to 13.2 in. Smallmouth bass PSD increased from 1993 (17) to 1999 (38), but has decreased since 1999 to a record low of 8 in 2004. Relative stock density (RSD12) has shown the same trend as PSD and is now at a record low of 3 (Figure 3). Smallmouth

growth has decreased since 2002 for all ages, is at historic lows for the river, and is approximately an inch slower than the Interior Plateau Ecoregion average for all ages (Table 2). An age-4 smallmouth averaged 9.8 in in 2004 compared to the ecoregion average of 11.2 in. Very few age-5, 6, and 7 smallmouth were sampled in 2000, 2002, and 2004.

Smallmouth bass population estimates (excluding young-of-the-year) ranged from 54/mi (RM 9.0) to 493/mi (RM 34.6) and averaged 248/mi. Previous average population estimates ranged from 91/mi (1999) to 299/mi (2003) (Figure 4). The 1998 population estimate was 96/mi. The 2002 and 2004 population estimates increased by 211% and 158% from 1998 levels. Population estimates by river mile by year are listed in Appendix 2.

#### Other game fish

A low level spotted bass population is present in the river. Not enough spotted bass were sampled to evaluate the population. The only other game fish sampled was one channel catfish. Largemouth bass are also present in low numbers as seen from previous surveys.

### DISCUSSION

The quality of Blue River's smallmouth bass population has deteriorated since the 12-in minimum length limit was imposed in 1998. The bass population has increased by 211% and 158% in 2002 and 2004 compared to 1998 results. However, the increase in population size has slowed smallmouth growth which has reduced the number of bass greater than 12 in in the population. This was indicated by the overall decreases in PSD's and RSD12's over the 7-year period. It appears that smallmouth bass harvest and/or natural mortality is impacting the number of older bass in the population because very few older bass (ages 5, 6, and 7) have been sampled over the last three population estimates. Some bass greater than 12 in should have been showing up in the population estimates even though growth was poor. Also, the large increases in the 2002 and 2004 population estimates indicate that smallmouth were being harvested prior to the imposition of the minimum size limit. The 1999 angler creel survey showed no smallmouth bass harvest which does not correspond with the population estimate survey data. It appears that the creel survey failed to accurately quantify smallmouth bass harvest.

The smallmouth bass population is now composed of small, slow growing fish. The only method to increase the numbers of larger bass is to increase bass harvest. Implementing a no minimum size limit or a slot limit will increase harvest. These regulations will reduce population

numbers, which will increase growth and hence increase the number of larger bass in the fishery. The slot limit would be preferred over a no minimum size limit because it would protect the bass that did manage to grow to larger sizes. However, for a slot limit to be effective at producing larger bass, the small bass must be harvested. The Blue's potential smallmouth harvest may be high enough to improve the population's size structure under different regulations because it appears that enough smallmouth were being harvested prior to 1998 to keep the population numbers down. Also, fishing pressure is relatively high (167 hrs/mi in 1999).

The Blue's smallmouth bass fishery was modeled using FAST (Slipke and Maceina 2001) to compare different slot limits to the 12-in minimum length limit under different conditional fishing (cf) and conditional natural (cm) mortality rates. The estimated range used for cf and cm was 0.15 to 0.40 and 0.30 to 0.44 which were derived from previous population estimates. The 10 to 13, 10 to 14, 11 to 14, and 12 to 15-in protective slot limits all would produce more larger smallmouth than the current 12-in limit. However, not enough smallmouth would be harvested under the lower slot limits of 10 and 11 in to improve the populations size structure. It was reported in Buynak and Mitchell (2002) that 88% of the anglers during an angler creel survey at Elkhorn Creek in Kentucky said the smallest smallmouth bass they would keep was 10 in. A higher slot limit of 12 in will provide greater opportunity for increased harvest. It is recommended to change the current size limit to a black bass 12 to 15-in protective slot limit with a five bass bag limit of which only two can be over 15 in. The reduced bag limit of two bass greater than 15 in may help increase the number of larger bass in the fishery over time. This was shown in Elkhorn Creek where the densities of smallmouth over 16 in steadily increased after the imposition of a 12 to 16-in slot limit with a two fish bag limit for bass greater than 16 in while the North Fork Elkhorn Creek smallmouth densities remained the same under a 12-in minimum length limit.

When the 12 to 15-in slot limit was modeled with cf of 0.15 ( $0.10 < 12$  in,  $0.05 > 15$  in) under a range of cm's from 0.30 to 0.45 it would theoretically increase the number of 15-in smallmouth by 20 to 22% when compared to the 12-in minimum length limit (Table 3). A cf of 0.40 ( $0.30 < 12$  in,  $0.10 > 15$  in) would theoretically increase the number of 15-in smallmouth by 50 to 57%, and changing the cf to 0.20 for bass less than 12 and greater than 15 in showed an increase of 59 to 65% (Tables 4 and 5). If it works, the fishery could turn into a premier smallmouth bass fishery, if it does not work the smallmouth population will not change much



from its present condition. The effectiveness of the new regulation will depend on anglers harvesting the small bass. The Blue River Commission will have to be notified of the new regulation before it is proposed into law.

The rock bass population is providing a quality fishery. The population estimates have increased steadily since 2000 and are 58% above 1998 levels. Growth is good even though the population has increased. Proportional stock density's and RSD8's were gradually increasing until the 2004 survey. In 2004 the population indices decreased, but a PSD of 18 and a RSD8 of 9 are still good indicators of a quality fishery.

All future fisheries work planned for the Blue River will be conducted under work plan 204759 entitled, Evaluation of Smallmouth Bass Experimental Management Strategies. One objective in this work plan is to increase the catch rate of 15-in and larger smallmouth bass by 50% over pre-experimental regulation levels. It was also noted in this work plan that the "Statewide 12 inch black bass minimum size limit was a good initial step in an attempt to provide higher quality bass in streams. However, all smallmouth bass populations do not behave the same and adjustments need to be made to increase the quality on certain bodies of water. Special smallmouth bass regulations will likely be proposed for a few smallmouth bass streams during the next round of administrative rules. Any rule changes adopted will likely become effective in either 2006 or 2007. This project will monitor any changes to the smallmouth bass fisheries in these "special regulation" streams." Population estimates under this work plan are to be conducted in 2006, 2008, 2010, and 2012 following the same procedures as previous Blue River population estimates.

#### RECOMMENDATIONS

- Change the 12-in black bass minimum length limit to a 12 to 15-in slot size limit where black bass under 12 in and greater than 15 in can be harvested.
- Change the black bass bag limit to five bass of which no more than two can be 15 in or larger.
- Conduct population estimates using the same procedures as in 2004 in 2006, 2008, 2010, 2012.

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Submitted by: Daniel P. Carnahan, Fisheries Biologist  
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Approved by: \_\_\_\_\_  
Brian M. Schoenung, Fisheries Supervisor  
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Table 1. Rock bass back calculated lengths (in) at each age, 1993 to 2004.

<u>Year</u>	<u>ROCK BASS BACK CALCULATED LENGTH (in) AT EACH AGE</u>							
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>
1993	1.9	3.0	4.4	5.8	6.9	7.8	8.6	9.0
1998	1.8	2.8	3.9	5.1	6.5	7.4	8.1	8.8
1999	1.8	2.8	3.9	5.0	6.2	7.3	8.2	
2000	1.8	2.8	3.8	4.9	6.3	7.5		
2002	2.1	3.4	5.0	6.5	7.6	8.4	9.1	
2004	1.8	2.9	4.4	6.0	7.4	8.3		
Interior plateau avg.*	2.0	3.6	4.9	6.6	7.2	7.8		

\* Shipman, 1997

Table 2. Smallmouth bass back calculated lengths (in) at each age, 1993 to 2004.

<u>Year</u>	<u>SMALLMOUTH BASS BACK CALCULATED LENGTH (in) AT EACH AGE</u>					
	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
1993	3.2	6.1	8.7	10.6	13.0	15.0
1998	3.3	5.5	7.9	10.3	12.8	
1999	3.3	5.7	7.9	9.9	12.1	13.3
2000	4.1	6.3	8.6	10.6		
2002	3.8	6.6	9.3	11.3		
2004	3.1	5.3	7.7	9.8		
Interior plateau avg.*	3.8	6.4	8.8	11.2	12.2	15.0

\* Shipman, 1997

Table 3. Number of 15 inch and larger smallmouth bass available under two different length limits with varying rates of conditional natural mortalities (cm). Total conditional fishing mortality (cf) is 0.15 and 0.10 for bass less than 12 in and 0.05 for 15-in and larger bass. The total population was set at 1,000.

<u>cm</u>	<u>12 in Limit</u>	<u>12-15 in Slot</u>	<u>% Difference</u>
0.30	58	72	20
0.35	34	44	22
0.40	20	25	21
0.45	11	14	21

Table 4. Number of 15-in and larger smallmouth bass available under two different length limits with varying rates of conditional natural mortalities (cm). Total conditional fishing mortality (cf) is 0.40 and 0.30 for bass less than 12 in and 0.10 for 15-in and larger bass. The total population was set at 1,000.

<u>cm</u>	<u>12 in Limit</u>	<u>12-15 in Slot</u>	<u>% Difference</u>
0.30	24	48	50
0.35	14	29	52
0.40	8	17	52
0.45	4	9	57

Table 5. Number of 15 inch and larger smallmouth bass available under two different length limits with varying rates of conditional natural mortalities (cm). Total conditional fishing mortality (cf) is 0.40 and 0.20 for bass less than 12 in and greater than 15 in. The total population was set at 1,000.

<u>cm</u>	<u>12 in Limit</u>	<u>12-15 in Slot</u>	<u>% Difference</u>
0.30	24	59	59
0.35	14	36	61
0.40	8	21	61
0.45	4	11	65

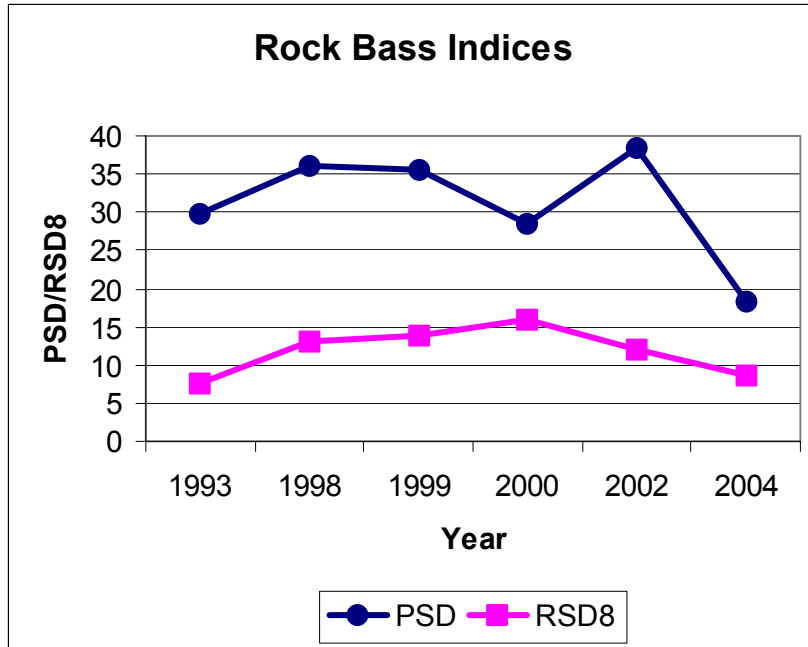


Figure 1. Rock bass PSD and RSD8 indices, 1993 to 2004.

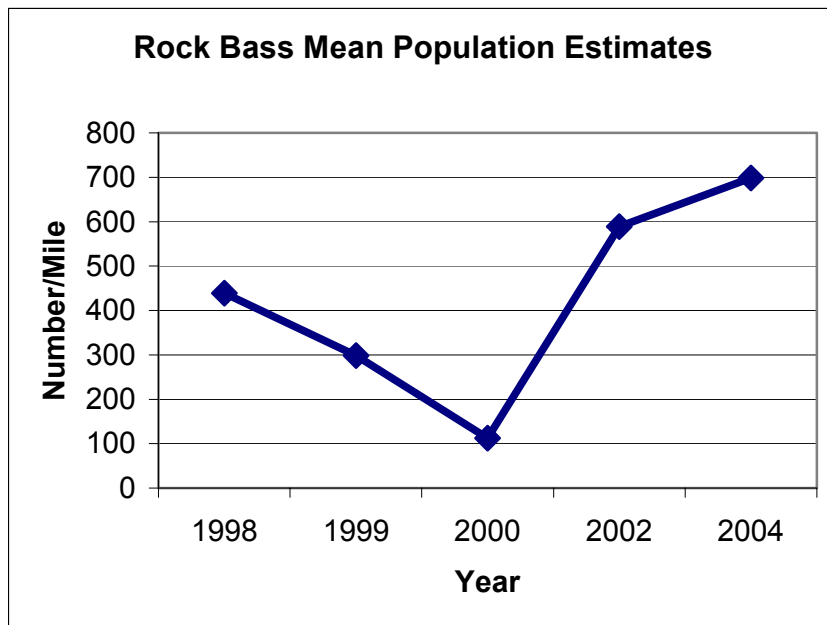


Figure 2. Rock bass mean population estimates, 1998 to 2004.

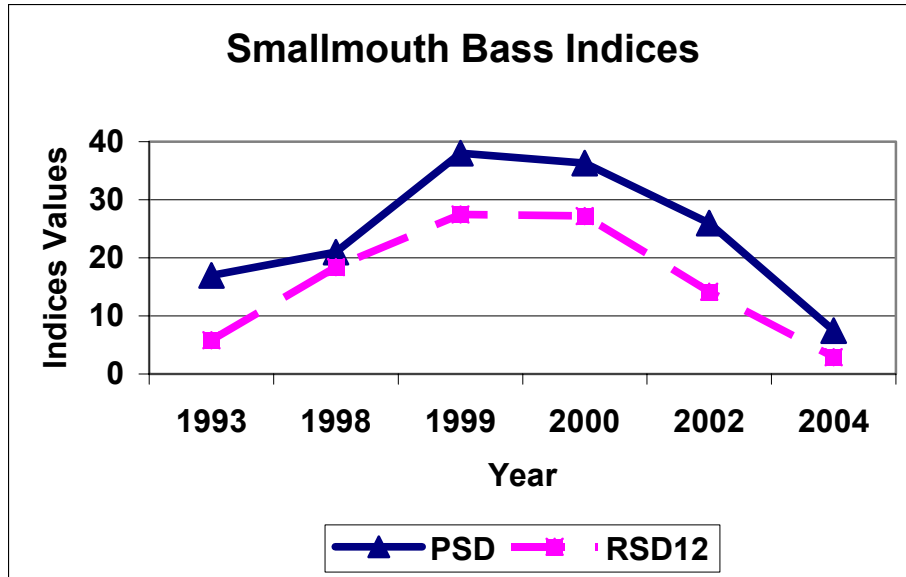


Figure 3. Smallmouth bass PSD and RSD12 indices, 1993 to 2004.

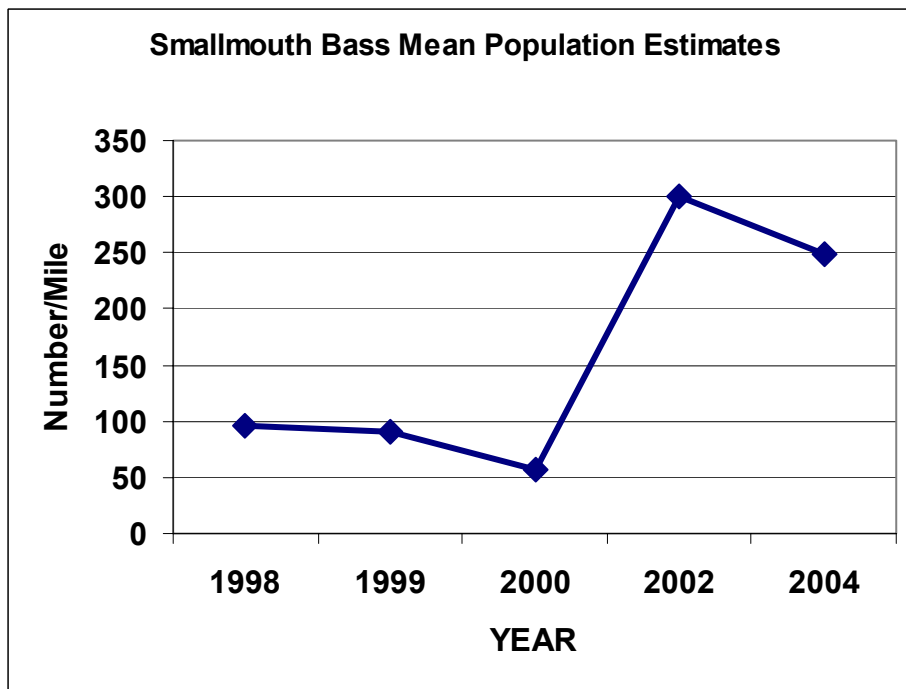


Figure 4. Smallmouth bass mean population estimates, 1998 to 2004.

## APPENDIX 1

Game Fish Population Estimate Survey Data, 2004



NUMBER, PERCENTAGE, WEIGHT, AND AGE OF ROCK BASS									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5	9	3.6	0.01	0	19.5				
2.0	2	0.8	0.01	1	20.0				
2.5	6	2.4	0.02	1	20.5				
3.0	6	2.4	0.03	not aged	21.0				
3.5	24	9.5	0.03	2	21.5				
4.0	42	16.7	0.04	2	22.0				
4.5	42	16.7	0.06	2	22.5				
5.0	20	7.9	0.08	2	23.0				
5.5	21	8.3	0.12	not aged	23.5				
6.0	17	6.7	0.15	3	24.0				
6.5	23	9.1	0.22	4	24.5				
7.0	12	4.8	0.24	4	25.0				
7.5	11	4.4	0.31	4, 5	25.5				
8.0	6	2.4	0.40	5	26.0				
8.5	4	1.6	0.48	5, 6	TOTAL	252			
9.0	4	1.6	0.53	6, 7					
9.5	3	1.2	0.61	7					
10.0									
10.5									
11.0									
11.5									
12.0									
12.5									
13.0									
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	N/A	GILL NET CATCH	N/A	TRAP NET CATCH	N/A
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NUMBER, PERCENTAGE, WEIGHT, AND AGE OF SMALLMOUTH BASS									
TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH	TOTAL LENGTH (inches)	NUMBER COLLECTED	PERCENT OF FISH COLLECTED	AVERAGE WEIGHT (pounds)	AGE OF FISH
1.0					19.0				
1.5					19.5				
2.0	14	8.6	0.01	0	20.0				
2.5	14	8.6	0.02	0	20.5				
3.0	2	1.2	0.02	0	21.0				
3.5					21.5				
4.0	5	3.1	0.03	1	22.0				
4.5	5	3.1	0.05	1	22.5				
5.0	9	5.6	0.06	1	23.0				
5.5	16	9.9	0.08	2	23.5				
6.0	15	9.3	0.11	1, 2	24.0				
6.5	11	6.8	0.14	2	24.5				
7.0	9	5.6	0.16	2	25.0				
7.5	9	5.6	0.20	2	25.5				
8.0	14	8.6	0.25	2	26.0				
8.5	8	4.9	0.28	2	TOTAL	162			
9.0	12	7.4	0.33	3					
9.5	7	4.3	0.41	3					
10.0	3	1.9	0.46	not aged					
10.5	2	1.2	0.51	not aged					
11.0	5	3.1	0.62	4					
11.5									
12.0	1	0.6	0.89	not aged					
12.5									
13.0	1	0.6	1.22	not aged					
13.5									
14.0									
14.5									
15.0									
15.5									
16.0									
16.5									
17.0									
17.5									
18.0									
18.5									

ELECTROFISHING CATCH	N/A	GILL NET CATCH	N/A	TRAP NET CATCH	N/A
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## APPENDIX 2

Game Fish Population Estimates by Sampling Station, 1998 to 2004

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Appendix 2. Game fish population estimates (number/mi) by sampling station, 1998 to 2004.

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Rock Bass

	River Mile					
<u>Year</u>	<u>9.0</u>	<u>14.7</u>	<u>34.6</u>	<u>54.5</u>	<u>62.4</u>	<u>Average</u>
1998	123	33	*	695	905	439
1999	62	300	407	379	343	298
2000	31	*	179	79	162	113
2002	223	1,080	564	505	571	589
2004	253	1,140	1,064	310	723	698

Smallmouth Bass

	River Mile					
<u>Year</u>	<u>9.0</u>	<u>14.7</u>	<u>34.6</u>	<u>54.5</u>	<u>62.4</u>	<u>Average</u>
1998	15	52	321	16	76	96
1999	0	100	179	53	124	91
2000	8	0	164	16	95	57
2002	138	580	564	100	114	299
2004	54	360	493	95	238	248

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\* Denotes insignificant population estimate.